Annual highlights

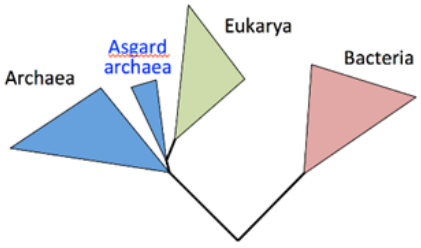
Center for Geomicrobiology, Aarhus University (2012—2017)

2016

At the Center for Geomicrobiology we explore microbial life in the subsurface seabed and its interactions with the geosphere. Our aim is to understand how microorganisms can subsist under extreme nutrient limitation, and how they differ physiologically and genetically from organisms in the surface world. Our research integrates highly diverse fields and methods, ranging from isotope geochemistry and biogeochemistry to microbiology and molecular biology.

Asgard Archaea

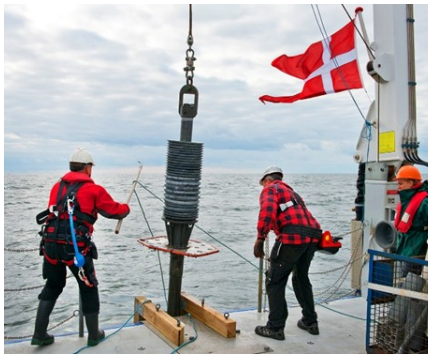
A newly discovered group of extraordinary archaea is now found to occur abundantly in marine sediments, such as in Aarhus Bay. These Asgard archaea are positioned at the base of Eukarya in the genetic tree of life and may thus represent a missing link in the early evolution of eukaryotes (animals, plants, etc.). They possess the genetic code to produce diverse proteins known so far only from eukaryotes. These proteins suggest that Asgard archaea have much greater cellular complexity than other prokaryotes, such as a cytoskeletal machinery and membrane remodeling and trafficking systems.



Position of the newly discovered Asgard archaea in the tree of life, at the base of Eukarya.

Cable Bacteria

Cable bacteria represent a unique lifestyle where the two half-reactions of the respiratory metabolism are separated to each end of cm-long cell chains. Cells oxidize sulfide or other substrates and the cable conducts the electrons to terminal cells that transfer them to oxygen or nitrate and thereby complete the respiration. We have now discovered, using Raman micro-spectroscopy, that c-type cytochromes are involved in the loading and unloading of electrons onto conducting wires that run through the filament in the periplasmic space. In spite of new and interesting results, the molecular mechanism of electron conductance is not yet resolved.

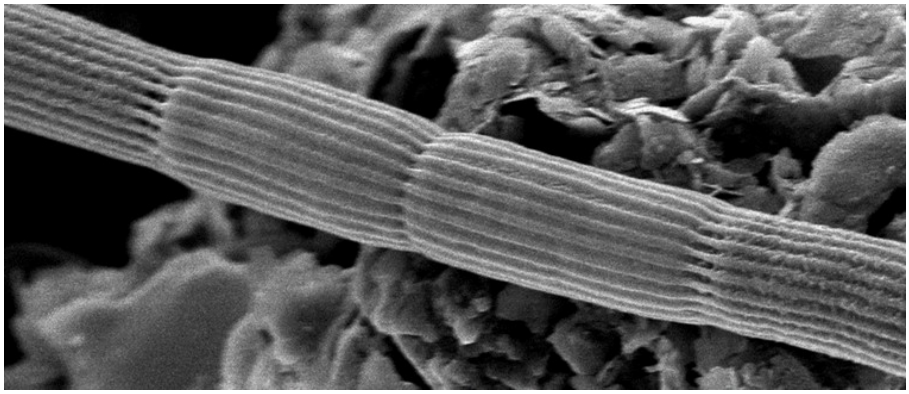


A gravity core is retrieved from the Baltic seabottom for methane studies on board the research vessel, Aurora.

Global Methane Cycle

The seabed is the greatest anaerobic bioreactor on Earth in which methane is a terminal product of organic matter degradation. Based on 700 sediment cores from all regions of the ocean, we have now developed a comprehensive database to quantify the role of methane in the global marine carbon cycle and determine the factors controlling its formation and degradation. Through new radiotracer experiments, we have discovered that the anaerobic microbial food chain leading to methane does not proceed directly through the general key intermediate, acetate, but rather via acetate through H2 and CO2 in an additional, yet unidentified step.

Below: Scanning electron micrograph of a 3 µm wide multicellular cable bacterium with ridges that contain putative electron-conducting wires.



Aarhus University's research vessel, Aurora.

More information:

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The Center's website:
www.geomicrobiology.au.dk

Examples of research dissemination:

- *ScienceDaily: "Microorganisms in the subsurface seabed on evolutionary standby" (20.03.2017)*
- ScienceNordic: "Discovery in the Bay of Aarhus can solve the puzzle of our primordial origin" *(16.02.2017)*
- *Jyllandsposten.dk: "Gennembrud: Aarhus Bugt kan gemme på nøglen til vores oprindelse" (12.01.2017)*